

Information Science and Technology Directorate
Defense Technical Information Center
Ft. Belvoir, VA 22060-6218

DTIC-E-TR-2010/04 May 5, 2010
Information Science and Technology Directorate
Research Report

Defense Technical Information Center's 2010 Student Paper Competition: The Winning Papers

Edited by
Carol E. Jacobson
Defense Technical Information Center



Approved for public release; distribution is unlimited.

Copyright © 2010 (Bachrach, Ben Eli, Hutchins and Lantzy). The U.S. Government and those authorized on its behalf are granted an unlimited, non-exclusive, royalty-free, world-wide license to use, reproduce, or release the work for U.S. Government purposes.

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.				
1. REPORT DATE (DD-MM-YYYY) 05-05-2010		2. REPORT TYPE Research Report		3. DATES COVERED (From - To)
4. TITLE AND SUBTITLE Defense Technical Information Center's 2010 Student Paper Competition: Winning Papers		5a. CONTRACT NUMBER		
		5b. GRANT NUMBER		
		5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S) Jacobson, Carol E. (Editor) Ben Eli, Ariane Hutchins, Jeremy Bachrach, Hanna C. Lantzy, Shannon		5d. PROJECT NUMBER		
		5e. TASK NUMBER		
		5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Defense Technical Information Center 8725 John J. Kingman Road Suite 0944 Fort Belvoir, VA 22060-6218		8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) Defense Technical Information Center 8725 John J. Kingman Road, Suite 0944 Fort Belvoir, VA 22060-6218		10. SPONSOR/MONITOR'S ACRONYM(S) DTIC-E		
		11. SPONSOR/MONITOR'S REPORT NUMBER(S) TR-2010/04		
12. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.				
13. SUPPLEMENTARY NOTES This compilation includes the winning papers for the 2010 Student Paper Competition - DTIC-E-TR-2010/05, DTIC-E-TR-2010/06 and DTIC-E-TR-2010/07. Copyright © 2010 (Bachrach, Ben Eli, Hutchins and Lantzy). The U.S. Government and those authorized on its behalf are granted an unlimited, non-exclusive, royalty-free, world-wide license to use, reproduce, or release the work for U.S. Government purposes.				
14. ABSTRACT In support of the DoD Scientific and Technical Information Program, DTIC sponsored an annual Student Paper Competition for students in graduate programs in library and information science. The purpose of the competition was to promote the generation of new research in areas of strategic importance to DTIC and to promote understanding of DTIC's mission and program among information professionals. Papers were evaluated based upon their relevance to DTIC's mission, potential interest to DTIC's customers, originality, clarity and sufficiency of support for conclusions. Authors of the best submissions are invited to present their papers at the DTIC Annual Conference which is being held on March 22-24, 2010 in Alexandria, VA. This year, a number of wonderful papers were submitted, and three of these papers were selected for presentation at the DTIC Annual Conference. The winning papers are included in this compilation.				
15. SUBJECT TERMS Web 2.0, libraries, Social networking, Intellipedia, National Aeronautics and Space Administration, NASA, Program Managers, User Needs, Information Needs, Science Program Executives, Information Seeking Behavior, 2010 Student Paper Competition				
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES 41
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified		
				19a. NAME OF RESPONSIBLE PERSON Carol E. Jacobson
				19b. TELEPHONE NUMBER (include area code) 703-767-9167

Information Science and Technology Directorate
Defense Technical Information Center
Ft. Belvoir, VA 22060-6218

DTIC-E-TR-2010/06 January 2, 2010
Information Science and Technology Directorate
Research Report

Being There is Only the Beginning: Toward More Effective Web 2.0 Use in Academic Libraries

by

Hanna C. Bachrach

Pratt Institute

School of Information and Library Science



Approved for public release; distribution is unlimited.

Copyright ©2010 (H. Bachrach). The U.S. Government and those authorized on its behalf are granted an unlimited non-exclusive, royalty-free, world-wide license to use, reproduce, or release the work for U.S. Government purposes.

Introduction

An increasing number of academic libraries are considering how to expand their presence on the Web, which has led many to adopt the practices of their users, creating accounts with popular social media services such as Facebook, Twitter, and Del.icio.us, and launching library blogs. There is a general acknowledgement among academic librarians, particularly those whose patrons are mainly undergraduate students, that these are now the “places” where patrons can be found. Kroski (2007) likens a handful of Web 2.0 favorites, including YouTube, Flickr, and MySpace (Facebook is probably more accurate in 2009), to “neighborhood hangouts where people convene to chat and express themselves. They provide a social space beyond work and home, where people go seeking a community experience. In so doing, they have helped transform the Web into a true ‘third place’” (p. 2011). Though we may not have previously considered the Web in exactly these terms, Kroski’s assertion does in fact mirror our experience as library professionals, particularly with our undergraduate patrons. It is just this experience that has led most academic libraries to quickly develop a presence in many of these Web spaces; simply put, we must meet our patrons where they are. Being there is certainly half the battle and most academic librarians now tend to agree that creating a presence is essential, but is it enough? What should we do once we’re there? Why should students want to “hang out” with us? Is “hanging out” even appropriate? How can we maintain our professionalism in such a context?

What is Web 2.0?

According to Kroski (2007), “Web 2.0 is loosely defined as the evolution to a social and interactive Web that gives everyone a chance to participate – not just those with programming skills” (p. 2011). Much of the current literature on Web 2.0 points to Tim O’Reilly’s definition: “Web 2.0 is the business revolution in the computer industry caused by the move to the internet as platform, and an attempt to understand the rules for success on that new platform. Chief among those rules is this: Build applications that harness network effects to get better the more people use them” (O’Reilly, as cited in Liu, 2008, p. 7). And finally, Liu (2008) describes the fact that “in the Web 2.0 era, the relationship between users and information is transformed from stand-alone, separate silos to mutually inclusive, mutually reliant, and reciprocal action-and-reaction entities” (p. 10).

For academic libraries’ purposes, Web 2.0 offers a new and fairly easy way to connect with patrons, promote our libraries, and offer our services in a convenient context. Web 2.0 applications are user-friendly, require no specific training or expertise, and are almost always free. These applications offer a variety of forums for self-expression, conversation, and information sharing. Undergraduate students are using them for a wide variety of reasons, but there is no question that they are, indeed, using them. I will argue later that although libraries are now using them too, we are not doing so to their full potential or in ways that actively invite our undergraduate patrons to interact with us in these new spaces. First though, we will examine how academic libraries are currently making use of these tools.

Current Use of Web 2.0

Web 2.0 encompasses a huge number of applications, interactive forums, and new communication styles. Academic libraries have most widely adopted the use of blogs, social

networking sites like Facebook, Twitter, social bookmarking, and wikis. Other Web 2.0 tools used by libraries include podcasting, personalized access to a library's website, RSS feeds, and media sharing. I will address a few of the more popular tools below.

Blogs

Blogs are perhaps the most popular Web 2.0 tool currently being used in academic libraries. Many libraries have them and those that don't probably have plans to start them soon. Having a library blog has nearly become "proper procedure" in academic libraries, but librarians still seem confused about how to use them effectively. Currently, most academic libraries are using their blogs as newsletters, loudspeakers, or library bulletin boards. In other words, blogs are being used to get information to patrons; news and events are publicized, newly acquired materials mentioned, general promotion of the library's services attempted. A 2006 survey conducted by Draper and Turnage gathered responses from 265 academic librarians about their library blogs. According to Draper and Turnage (2008),

The majority (86%) said that they used their blog to discuss news and events. A large number (70%) also said they used their blog as a way to market the library...One librarian simply said it was meant to build a relationship with users. (p. 19)
Bardyn (2009) recognizes a problem in the lack of connection spurred by library blogs.

She refers to the results of a 2008 national survey of 22 academic health sciences libraries, when she writes:

Only one out of 22 blogs surveyed received comments on a regular basis, suggesting that almost all librarian bloggers these days find themselves struggling with the problems of how to integrate content into the enterprise and how to engage users in library initiatives. (p. 12-14)

Allan (2009) suggests using the library blog to create a new type of research guide. He gives some basic instructions:

You should probably limit yourself to one subject area per blog, keep the posts short, continue to generate new, interesting posts, and do not engage in blog mission creep with current news items or developments in the library information world. Try also to include a summary of your intentions on the front page. (p. 21)

Though Allan may have some unique ideas for the use of academic library blogs, most libraries are using their blogs exactly the way they might have used their paper newsletters ten years ago. The Undergraduate Library at the University of Illinois at Urbana-Champaign (<http://www.library.illinois.edu/>), for example, actually calls their blog the "News and Events Blog" and some recent posts include "Online Catalog Update June 14-17," "Remodeled Café," and "Gaming Career Night." Every blog post announces a library event or alerts students and faculty to an upcoming change or interruption in service. With very few exceptions, the academic library blogs I examined were similar in nature to Urbana-Champaign's. Not only did these blogs focus almost exclusively on news and events, but they also shared the characteristic

of being hidden, or deeply buried on their libraries' websites. In several cases, I only found them after performing a search for the word "blog" on the libraries' sites.

It is worth mentioning here that while many of the smaller colleges' libraries that I examined did not have blogs, they nearly all had frequently-updated "library news" pages that functioned in almost exactly the same way as the larger schools' blogs, with the only exceptions being the lack of space for comments and the lack of an identifiable "author." Hollins University's Wyndham Robertson Library (<http://www.hollins.edu/academics/library/libtoc.htm>) calls their news page "What's New" and some recent posts include "New Journals in JSTOR and Project Muse" and "The Library Forms Student Advisory Committee." Similarly, recent posts to Hobart and William Smith's Warren Hunting Smith Library's (<http://academic.hws.edu/library/>) "Library Updates" page include "J. G. Vail Portraits Online" and "Archives Open for Reunion Weekend."

One exception to these general trends is the library at the University of Minnesota (<http://www.lib.umn.edu/>), which has introduced a program called "UThink," which offers to host both student and faculty blogs free of charge and links them to the library's website. While the goals of this program are totally different than those of a library's own blog, it is indicative of ways in which academic libraries can support the practice of blogging in their communities. In a brief report on the UThink program, Albanese (2004) observes:

UM officials think blogs may transform the academic enterprise – and they want the library to be part of that. Already, Nackenrud [UM librarian] said, professors have said that they'll use the blogs for specific classes to encourage discussion and debate. (p. 18) Despite such occasional innovation, all evidence points to the fact that, in most cases, users are receiving library blogs in exactly the same way they once received paper newsletters: as passive consumers.

Social Networking Sites

Just a few years ago, when discussing social networking sites, it would have been necessary to address the use of MySpace, Friendster, and perhaps several others in addition to Facebook. In 2009, though, Facebook use has far eclipsed the use of any other social networking site and certainly among academic libraries, there is some recognition that this is where our students are. When Kroski asserts that Web 2.0 tools provide a "third place," it is Facebook that comes immediately to mind. We are aware that students, particularly undergraduates, spend more and more of their time on Facebook, posting photos and videos, writing "notes," commenting on each other's "walls," taking quizzes, and generally "hanging out." If this atmosphere doesn't sound particularly scholarly, that is because it's generally not. So why are academic libraries interested in Facebook? We have the goal of meeting our patrons where they are and much of the time, Facebook is that shared space. In an effort to connect with their students, many academic libraries have created their own Facebook pages, of which their students, faculty, and colleagues can opt to be "fans." The question, again, is what exactly libraries are doing with these pages and how effectively they are using Facebook to reach out to their users.

Kroski (2007) describes academic libraries as "utilizing social networking communities as marketing platforms, tools for outreach, and networking venues" (2019). In the same article, she asserts that "By building a presence within an online community where many of their patrons

currently interact, the library becomes more accessible and highly visible to a large demographic of potential users” (2019).

A 2006 survey conducted by Charnigo and Barnett-Ellis gathered responses from 126 academic librarians regarding their experience with and impressions of Facebook. According to Charnigo and Barnett-Ellis (2007), most of the librarians surveyed felt that Facebook was a distraction and did not have much academic merit, however,

Some librarians were so enthusiastic about Facebook that they suggested libraries use the site to promote their services....One librarian wrote: ‘Facebook (and other social networking sites) can be a way for libraries to market themselves. I haven’t seen students using Facebook in an academic manner, but there was a time when librarians frowned on e-mail and AIM too. If it becomes part of students’ lives, we need to welcome it. It’s part of welcoming them, too.’ (p. 30)

In 2006, these more enthusiastic respondents predicted exactly the ways in which academic libraries in 2009 are now using Facebook.

Similar to their use of blogs, academic libraries are using Facebook pages to market themselves and their services and to make announcements. Unlike their blogs however, libraries’ Facebook pages are clear about how their librarians can be reached (for the most part, via phone, chat, text message, email, or in person), often include photographs both of staff members and interesting aspects of the collections, and occasionally post notes that might be helpful to their patrons. Hollins University’s Wyndham Robertson Library’s Facebook page, for example, has begun posting numbered “Info Tips” with titles such as “Subject Headings Demystified,” “Google is Our Friend,” and “Plagiarism 101.” Also unlike the hard-to-find blogs, many academic libraries, including both Hollins University and Urbana-Champaign, include large Facebook logos on their homepages, inviting patrons to “Find us on Facebook.” Clicking on these logos takes patrons directly to the libraries’ Facebook pages.

Whether or not they feel that it serves as a major distraction, most academic libraries have recognized that their students spend a vast amount of time on Facebook. And wisely, they’ve realized that going to the place where their patrons are is one of the most significant ways of serving them. Currently, academic libraries’ Facebook pages seem more alive and three dimensional than their blogs; continuing to keep these pages fresh and relevant will likely become more of a challenge with time.

Twitter

The most recent addition to the array of Web 2.0 services, Twitter enables what is referred to as “microblogging,” or in other words, Facebook status updates, sans the rest of Facebook. Twitter updates are typically no longer than a single line of text and personal Twitter updates might read “Writing about Web 2.0 in academic libraries” or “At the beach, soaking up some sun.” Many users update their “tweets” from mobile devices, creating a near-constant stream of short dispatches from their lives, whether personal or professional. As a Twitter-user, one “follows” a list of other Twitter-ers; updates from these chosen users appear in one’s ever-growing stream of visible “tweets.” Twitter also allows users to track all “tweets” relevant to a given topic. Twitter is used, not only by individuals, but by businesses and institutions as well.

Academic libraries are no exception and in fact, Mansfield, in a 2009 *University Business* article, claims that “Simple and powerful, Twitter is a must for higher education” (§ 2).

The question, of course, is how to best use yet another Web 2.0 forum to promote the academic library and/or build relationships with its patrons. Mansfield (2009) specifically cautions Universities against using Twitter for news in her article’s second tip: “Don’t use Twitter for RSS or publish “News”....No offense, but new releases are not that interesting to read. That’s why Twitter profiles that are simply RSS have very few followers” (§ 5).

There is very little agreement in the field as to whether, and if so how, to use Twitter in libraries. In his 2009 article “Higher Ed Wakes Up to Twitter,” Bell (2009) wonders whether Twitter makes sense as a tool for academic libraries. He writes:

I’m on the fence about the value of Web 2.0 technologies for academic libraries. The effectiveness of our blogs, Facebook profiles, and promotional YouTube videos is questionable, and whether a critical mass of college students is even using Twitter is a topic of debate. (§ 3)

And in a 2009 *Computers in Libraries* article titled “Twitter for Libraries (and Librarians),” Milstein is clearly at odds with Mansfield’s earlier point when she describes that “Short messages can tell people about events such as readings, lectures, and book sales; newly available resources; or changes in the building hours” (p. 17).

Though not as heavily used as blogs or Facebook, academic libraries who are using Twitter at all are most often using it for news, regardless of Mansfield’s warning. Both Dickinson University’s Waidner-Spahr Library (<http://library.dickinson.edu/library/>) and the University of Vermont’s Bailey/Howe Library (<http://library.uvm.edu/>) have Twitter accounts that appear to be used strictly for news. A few recent “tweets” from Dickinson include “On July 3rd, the library will be open from noon to 4:00 PM” and “The Belles Lettres Literary Society is sponsoring a poetry reading in the library this Thursday at 7:30.” Dickinson’s Twitter account currently has 282 “followers” and Vermont’s account has 280. Though Urbana-Champaign’s Undergraduate Library “tweets” the occasional news item, their account is generally used a bit more creatively, attempting to use library resources to deliver interesting facts and draw patrons into the library. A recent example is the following “tweet,” which was posted on July 31: “Jimmy Hoffa disappeared today in 1975. Read about the famous Teamster President’s life and mysterious death: [link to catalog search results on Jimmy Hoffa].” Urbana-Champaign’s Twitter account has 475 “followers.”

Academic libraries are embracing the use of Twitter, but the majority seems to view the medium as simply another way to transmit library news items to their university communities. If blogs are treated as Web-based newsletters, Twitter accounts are treated as campus flyers, used to make brief announcements. After examining quite a few academic libraries’ Twitter accounts, I began to wonder if bright paper flyers themselves are being used to alert students and faculty to the existence of these accounts. Though Urbana-Champaign features their most recent “tweets” on their homepage and links directly to Twitter, neither Dickinson nor Vermont promote their Twitter accounts on their websites at all. In fact, I was only able to find both accounts by searching Twitter, rather than the libraries’ websites. While many academic libraries are using Twitter, more or less effectively, as another way to communicate with their patrons, there seems to be a disconnect in the realm of promoting or marketing this new technology itself. Perhaps,

given the fact that these accounts have “followers” at all, the libraries are using less technological methods of spreading the word, but a link from the homepage would be a helpful and obvious addition.

Suggestions for More Effective Use

A wide array of Web 2.0 services offers academic libraries new and exciting ways to serve their patrons. The boundaries of place that once tied us to the limited formats of bulletin boards, newsletters, and flyers has disappeared, but much like prisoners who have become so accustomed to the confines of our cells, we have not yet taken advantage of the fact that the doors and windows have been thrown wide open. We may recognize that Web 2.0 tools offer us new ways of reaching patrons, but we’re using these tools in the same old ways. Blogs, Facebook, and Twitter invite interaction, personality, and innovation. Yet academic libraries persist in using them to post library hours, changes in service, and event times. Certainly our patrons still need this information and the web is now our forum for information dissemination. However, our patrons are increasingly using Web 2.0 services with much greater ease and fluency than we are. Going to their spaces is not enough; we must also learn their language.

What does it mean to learn the language used by our patrons? First, it means gaining an understanding of how they use virtual spaces like Facebook. Much more than a place to read about upcoming events or new library materials, Facebook is a forum for self-expression. It provides a fluid user experience and though users do gather and share information here, they do so in a way that is very far from dry and institutional. Mansfield (2009) suggests that universities find a way to participate in much the same fashion:

Put authenticity before marketing. Have personality. Build Community. Colleges and universities that are most successful at utilizing social networking websites like Twitter, Facebook, and MySpace know from trial, error, and experience that a ‘marketing and recruitment approach’ on social networking sites does not work. Simply put, it comes across as lame to the technologically hip users of social networking sites. Traditional marketing and development content is perfectly fine for your website, e-mail newsletters, and print materials, but Web 2.0 is much more about having personality, inspiring conversation, and building online community....Relax, experiment, let go a bit, find your voice, be authentic. (¶ 4)

Of course academic libraries are institutions, not individuals, and as such, have a responsibility to remain professional, informed, and often objective. These constraints, however, do not prevent us from developing personalities as institutions, using our web space to project those personalities, and occasionally having some original thoughts or a sense of humor. Our patrons are looking for signs of life and too often, they’re not finding them. What does this mean for the practical purposes of academic libraries looking for ways to enhance their Web 2.0 presence and make it more relevant? Depending on a library’s goals, it could be as simple as offering a librarian with a particular interest the chance to blog about that topic, developing funny and interesting ways to promote your library staff and materials through frequent “tweets,” or simply creating obvious and inviting links to these services from your library’s homepage. Speaking the language of your library’s Web 2.0-savvy patrons is really just about replacing institutionalism with authenticity, in whatever unique way that makes sense for your library.

Web 2.0 is not going away and the more we're able to use its strengths to benefit our libraries, the more relevant we will remain to our students, faculty, and communities.

The Future of Web 2.0 in Academic Libraries

Currently, there is a focus among academic libraries on Web 2.0 tools themselves, rather than on the changing forms of communication and collaboration they enable. While this approach is understandable given their relative "newness," it is one that is quickly growing irrelevant. While libraries are still focused on "having" a blog or "getting" a Facebook account, their patrons have moved on to using these tools effortlessly, almost as extensions of themselves, with little care for or awareness of the tools themselves. As Beard and Dale report in their 2008 article, "Redesigning Services for the Net-Gen and Beyond:"

In 2006, Martin and Madigan observed 'The virtual world does not sit 'out there' like a parallel universe...it invades and conditions the real world....' The university library is uniquely positioned at the congruence of the real and virtual worlds and librarians need to seize the opportunities presented by [this] shift.... (p. 111)

All signs point to the fact that the use of Web 2.0 in the future will be very different from its use in academic libraries today. The tools that we know as Facebook, Twitter, YouTube, etc. will recede into the background of our awareness and experience, as we shift toward a reality that encompasses both our physical and virtual experiences. Academic librarians will become increasingly disconnected from our patrons if we persist in adopting new technologies, only to repeatedly return to outdated modes and methods of communication.

Reference List

- Albanese, A. (2004). UM library offers free blogs. *Library Journal*, 129(9), 18.
- Allan, C. (2009). Evolve your research guides into the Web 2.0 ecosystem. *Texas Library Journal*, 85(1), 20-21.
- Bardyn, T. (2009). Library blogs: What's most important for success within the enterprise? *Computers in Libraries*, 29(6), 12-16.
- Beard, J., & Dale, P. (2008). Redesigning services for the net-gen and beyond: A holistic review of pedagogy, resource, and learning space. *New Review of Academic Librarianship*, 14, 99-114.
- Bell, S. (2009, May 21). Higher ed wakes up to Twitter. *Library Journal*. Retrieved July 18, 2009, from <http://www.libraryjournal.com/article/CA6659755.html>
- Charnigo, L., & Barnett-Ellis, P. (2007). Checking out Facebook.com: The impact of a digital trend on academic libraries. *Information Technology and Libraries*, 26(1), 23-34.
- Draper, L., & Turnage, M. (2008). Blogmania: Blog use in academic libraries. *Internet Reference Services Quarterly*, 13(1), 15-55.
- Kroski, E. (2007). The social tools of Web 2.0: Opportunities for academic libraries. *Choice*, 44(12), 2011-2021.
- Liu, S. (2008). Engaging users: The future of academic library web sites. *College & Research Libraries*, 69(1), 6-27.
- Mansfield, H. (2009, May). 10 Twitter tips for higher education: Making a home in the Twittersverse, one tweet at a time. *University Business*. Retrieved August 1, 2009, from <http://www.universitybusiness.com/viewarticle.aspx?articleid=1285&p=1#0>
- Milstein, S. (2009). Twitter for libraries (and librarians). *Computers in Libraries*, 29(5), 17-18.

Information Science and Technology Directorate
Defense Technical Information Center
Ft. Belvoir, VA 22060-6218

DTIC-E-TR-2010/05 February 8, 2010
Information Science and Technology Directorate
Research Report

Intelligence after Intellipedia: Improving the Push Pull Balance with a Social Networking Utility

by

Ariane Ben Eli and Jeremy Hutchins

Pratt Institute

School of Information and Library Science



Approved for public release; distribution is unlimited.

Copyright ©2010 (A. Ben Eli and J. Hutchins). The U.S. Government and those authorized on its behalf are granted an unlimited non-exclusive, royalty-free, world-wide license to use, reproduce, or release the work for U.S. Government purposes.

Defense Technical Information Center
Student Paper Competition
2010 Conference

Author Names: Jeremy Hutchins
jhutchin@pratt.edu
(917) 374-0723

Ariane Ben Eli
abeneli@pratt.edu
(917) 892-4706

School Affiliation: Pratt Institute
School of Information & Library Science
144 West Fourteenth Street
New York, NY 10013

Department chair: Dean Tula Giannini, Ph.D., MLS, MM
giannini@pratt.edu

Title: **Intelligence after Intellipedia: Improving the Push Pull Balance with a Social Networking Utility**

Abstract:

In response to the terror threat following September 11, 2001, the United States set up an intelligence hub to aggregate, assess and analyze data and intelligence produced by the 16 agencies and departments that make up the Intelligence Community. The hub, first called the Terrorist Threat Integration Center and succeeded by the National Counterterrorism Center, collaborates with foreign allies and draws on at least thirty databases to track threats and determine the credibility of intelligence. There is now no shortage of data and information to be turned into intelligence; the new challenge lies in convincing agencies to truly cooperate to reach national security goals. This paper seeks to study various approaches for increasing cooperative problem solving by examining existing tools. It proposes better knowledge management through the implementation of database comparison tools within an online social network to encourage new, dynamic intelligence cooperation that connects the dots between isolated items of intelligence and thus makes intelligence more timely and actionable.

Introduction:

Following the attacks of September 11, 2001, the United States intelligence community took steps to increase collaboration between all parts of the government to apprehend terrorists and prevent future attacks. This new whole-of-government approach was embodied in the creation of the National Counterterrorism Center (NCTC) in 2004. The NCTC would act as a hub, with analysts from the 16 intelligence agencies working side by side, sharing networks, databases, and information. When actionable intelligence emerged, the NCTC, through its Interagency Threat Assessment and Coordination Group (ITACG) would be able to communicate with state, local, tribal and federal law enforcement to respond in near real-time to threats as they emerged.

A First Step: Creating the Intelligence Hub

The NCTC's online digital library, NCTC Online (NOL) would enable access to intelligence agencies' networks and websites. A 2006 internal report card indicated that NOL hosted over 6,000 users and 6 million documents from over 60 contributing departments and agencies. Its identified user groups included the Terrorist Screening Center, National Security Agency, Defense Intelligence Agency, Department of Homeland Security, State Department, Daily News Update of the Department of Defense, Department of Defense, Federal Bureau of Investigation and the Central Intelligence Agency. In his statement for the record before the House Homeland Security Committee's Sub-Committee on Intelligence, Information Sharing and Terrorism dated 13 March 2008, Michael Leiter, then Acting Director of the NCTC said,

"I cannot overstate the importance of NCTC Online Secret (NOL(S)). From my perspective, NOL(S)--a secure, classified website designed to mirror the Top Secret version that is used broadly by federal officials--is a, if not the, key access point to counterterrorism information for SLT...we must increase the utility of NOL(S) as well as increase SLT awareness of NOL(S)...We are working with our federal partners...to ensure an even richer data set. This will include reporting related to breaking events, daily terrorism related situational reports, as well as an array of foundational reports..."

Elsewhere, NOL(S) is described as a vast data warehouse, drawing from not just the intelligence community, but public records, the Department of Agriculture, the Bureau of Alcohol, Tobacco, Firearms and Explosives, police departments, Commerce, Energy, the Federal Aviation Administration, the Department of Transportation, the Federal Reserve and others. Until at least 2008, the resource gave users access to CIASource and SIPRNet, the Defense Department's communications backbone, used for passing tactical and operational information at the secret classification level.

The goal of the NCTC was to aggregate, integrate, analyze and effectively disseminate actionable intelligence to the appropriate users rapidly. One challenge for the agency, from the beginning, was asserting its authority of agencies and departments with their own established hierarchies, leadership, and goals. The FBI was not eager to share everything with the CIA, DIA or anyone else and vice versa.

Getting the various arms of the intelligence community to work together was a high priority at the NCTC. In fact, its publicly accessible webpage trumpets that "collaboration is one of our best weapons against terrorism"¹ In its promotional video, the NCTC describes itself as "the central and shared knowledge bank of all known and suspected terrorists and international terrorist groups." The creation of intelligence hubs to aggregate data and information and to facilitate what was commonly called collaboration before 2009 may have been seen as a way to increase efficiency when responding to current and emerging security threats.²

Intellipedia as a Collaborative Intelligence Tool

In 2006, the United States intelligence community announced its new tool, *Intellipedia*, a wiki and blog network for its 16 agencies and departments to share information and collaborate on intelligence products. By most accounts, the project has been a useful tool for the agencies and departments that actually use it. Because users are not anonymous, they have a stake in being accurate and honest. When users input inaccuracies, other members of the community rapidly correct them.

Intellipedia grew out of a 2004 paper authored by D. Calvin Adrus, entitled "The Wiki and the Blog: Toward a Complex Adaptive Intelligence Community," which proposed that US policymakers, war-fighters and law-enforcers must learn to operate in a security environments that is changing rapidly in ways they cannot predict.

"The only way to meet the continuously unpredictable challenges ahead of us is to match them with continuously unpredictable changes of our own," he wrote. Basing his proposal on six elements of complexity theory that he outlined, he suggested that a wiki—a community organized, collaborative encyclopedia, which could be edited by any user, and which allows free flowing comments and discussion—would behave as a self-organizing tool for the intelligence community.

In describing *Wikipedia*, the most well known of several wiki websites, Adrus wrote, "from little bits of work by many, many people following simple rules of content contribution and editing, the most comprehensive, authoritative, and bias-free encyclopedia in the world has been produced in four years. This is an encyclopedia that is dynamically and constantly changing in response to the world as the world itself is changing." In describing how a wiki

¹ from NCTC video transcript available at <http://www.nctc.gov/docs/nctc-video-transcript.pdf>, and accessed 2/5/2010 13:58:00

² Whether hubs actually result in greater efficiency is debatable. In November 2008, Google Flu Trends reported it could accurately predict flu outbreaks between seven and 14 days earlier than the Federal Centers for Disease Control and Prevention based on Google users' search terms and geographical locations. See <http://www.google.org/flutrends/>.

The reason given was that people would search for their symptoms online before visiting a healthcare provider, while the CDC relied on reports from healthcare providers to make its own forecasts.

could work for the intelligence community, Andrus suggested that “A healthy market of debatable ideas emerges from the sharing of points of view. From the ideas that prosper in a market will arise the adaptive behaviors the Intelligence Community must adopt in order to respond to the changing national security environment.”

Andrus’ paper was published in 2005. By the end of the year, a pilot program had begun to create *Intellipedia*, and it was formally announced in the fall of 2006. In the six months from April to October of that year, *Intellipedia* had already grown to 28,000 pages and had 3, 600 users, according to news reports. By the fall of 2009, the site was home to 900,000 pages and had 100,000 registered users. It averaged over 15,000 page edits a day.

Intellipedia as an idea perfectly coalesced with the collaborative goals of the national security and intelligence communities at the time. Wikis by their very definition are collaborative, relying on the collective wisdom of the group for their timeliness, factually correctness and accuracy. Yet in early 2009, Chris Rasmussen, a social-software knowledge manager at the National Geospatial Intelligence Agency was quoted at length detailing some of the challenges *Intellipedia* had encountered. By Rasmussen’s estimate in February 2009, “all those who would have joined and shared their knowledge on the social networking site have already done so.” Further, few intelligence agencies had incorporated *Intellipedia* into their formal decision making process.³ Many agencies duplicated information, he said, using *Intellipedia* as a shadow system. “An agent may have had an informative conversation on *Intellipedia*, but then documents the exchange on some agency’s official system as well, ‘if you move the content and the conversation to the new space, why maintain the old?’” Rasmussen asks. To the authors of this paper, at least, the answer seems obvious: without *Intellipedia* the conversation wouldn’t happen at all.

Despite these successes, the Defense Department’s 2010 Quadrennial Defense Review calls for even greater cooperation. While the change from *collaboration* to *cooperation* may simply be semantics, this could signal a real change in policy. To understand the difference between *collaboration* and *cooperation*, one might think of a group of students at work at the same time. If the students are actively engaged in say, tagging a shared map of their city to identify streets, businesses, municipal buildings, schools, parks and places they have in some way claimed, they might be understood to be collaborating. The map they make relies on the input of everyone involved and is fundamentally changed by their participation. If, however, each student is engaged in making his or her own map but must share the tools and limited resources available with the other students at the table (and they achieve some balance and harmony in their tool sharing), they are better understood to be cooperating.

The authors believe that while collaboration is important, and has been shown to work with tools like *Intellipedia*, cooperation may be more feasible as a goal for the intelligence community. In her statement before the Council on Foreign Relations, Michele Flournoy, the undersecretary of defense for policy, said, “we need to emphasize cooperation more in

³ “Intellipedia suffers midlife crisis.” By Joab Jackson, *Government Computer News*, February 18, 2009, retrieved February 8, 2010 <<http://gcn.com/Articles/2009/02/18/Intellipedia.aspx>>

everything we do – to think more deeply about what our allies and partners abroad and civilian partners at home can bring to the table.”⁴

While collaboration was achieved in large part by the introduction of technological tools, and while technological tools will play a large part in achieving greater cooperation, as well, knowledge management must be a first consideration when attempting to get agencies with valid security concerns, and the legacy of Cold War secrecy, to act cooperatively. One lesson of *Intellipedia* is that younger members of the intelligence community who are already more comfortable in a social networking environment are more likely to adopt such tools at work. Since many of the decision makers and high officials in the national security and intelligence communities are veterans of Cold War policies, it's the job of knowledge managers to show them how these new tools, greater cooperation, and less secrecy within the community will lead to real results—less data loss between agencies, better intelligence products, and real time response to national security situations, before they develop into life threatening events. To borrow from Rasmussen, if an FBI agent were writing a useful article about Fidel Castro but tagged it with an agency identification (FBI in this example) instead of identifying the substantive issues of his article, (Fidel Castro, Cuba, etc.), the information would be, for all intents and purposes, lost.

Unfortunately there has been a real problem with data loss during aggregation within the intelligence and defense communities. On January 5, 2010, less than two weeks after Umar Farouk Abdulmutallab, a 23-year-old Nigerian terrorist who claimed affiliation with Al Qaeda, tried to blow up a Northwest Airlines jet on its approach to Detroit, President Barack Obama outlined a series of changes in security procedures aimed at making Americans less vulnerable to terror attacks. His announcement came after two hours of talks with the heads of 20 departments and agencies, including the CIA, FBI, DHS, and the National Counterterrorism Center.

“This was not a failure to collect intelligence, it was a failure to integrate and understand the intelligence that we already had,” President Obama said.

Knowledge Management Prevents Information Loss

Knowledge management gives organizations a series of tools to make decision makers smarter, faster. It seeks to shed light on what one might call the unknown knowns, knowledge that exists within an agency or department but is unacknowledged or poorly understood. In business, the idea that all sorts of valuable information such as customers'

⁴ Prepared Remarks: Michèle Flournoy, Undersecretary of Defense for Policy, p. 11, Council on Foreign Relations, February 2, 2010

http://www.cfr.org/publication/21350/prepared_remarks.html

preferences or employees private knowledge – was simply disappearing into the cracks which separate teams and business units led to the emergence of knowledge management as a discipline. People within their silos could not or would not share knowledge. There was a lingering sense of unconnectedness, of dots still not being joined up.

Intellipedia has achieved some success in connecting dots. However, its shortcoming is that to a great extent it still operates as “pull intelligence;” that is to say, users within the system have to seek out information. In order to seek out information, someone has to have a reasonably good idea of what they are looking for. One of the challenges for knowledge managers, some of whom may come from a library background, is that posed by the basic reference interview—smart people frequently haven’t narrowed down large topics into relevant questions. Someone writing a paper such as this one might begin with a topic as broad as counterterrorism itself. The job of the reference interview is to narrow the topic down enough to arrive at relevant results.

Pull intelligence is, of course, extremely valuable. It means that when a person asks for items related to a particular topic, they are able to get relevant information that broadens understanding, informs reports, opinions and ultimately decision-making. But to know what to pull, frequently people benefit from what is called push intelligence: the sort of intelligence that is offered without asking. This provides users with resources that also broaden their understanding, inform reports and opinions and ultimately decision making, but that the user might not find on their own, that might be totally relevant but not immediately obvious. What someone receives as push intelligence may influence what sort of intelligence they pull on their own.

Push intelligence may prevent data and information from slipping through the cracks, relevant intelligence from being ignored or lost, and it can also demonstrate the value of interagency cooperation. After 8 years of focused action to increase collaboration in the counterterrorism and defense communities, it seems reasonable to assume that the national security and intelligence community is awash in data. The challenge now is to make sure that data isn’t lost, that it becomes intelligence, and that this intelligence is timely, accurate, actionable and acted upon. Now is the time for a new knowledge management approach.

Knowledge management is most effective when it gets people to talk to one another, to share ideas and bits of information, to be able, through cooperation to see previously unrecognized patterns, make hidden connections and correlate, and even fuse, intelligence as a result. By setting up an intelligence hub, the US government sought to create the environment in which this sort of confluence of ideas would flourish, where data and information would be transformed into actionable intelligence. But shared databases which permit users to enter comments, daily video conferences and frequent email between working groups do not automatically translate into rigorous fact following. In a blog post dated January 4, 2010 Harvard Business School’s Rosabeth Moss Kanter said that dispatching e-mails or entering comments into databases is not enough. Only “relentless

follow-up” would hold colleagues accountable for what they were supposed to be doing. Ms. Kanter wrote:

“To be meaningful, isolated pieces of information must be connected. The NW 253 debacle was preceded by missed signals and uncorrelated intelligence — however partial, incomplete, and non-obvious — as an unnamed federal official told New York Times reporters. But isn't non-obvious the point of secrets? If somebody stumbles upon a bit of information but works in isolation, he or she might not see its significance. In an era of social networking, instant messaging, and continual tweeting, it should be easy to encourage people to share and connect their data points to find patterns. Leaders should reward pattern-recognizers.”

Ms. Kanter's remarks strike on something that may be achieved through a thoughtful combination of knowledge management technology solutions and applied human aptitude. There are tools which exist, including shared databases (both open source and classified), visualization software and geospatial imaging as well as civilian-created data such as personalized Google maps, news archives, blogs, and tweets. Might there be social networking solutions for making existing tools more useful in revealing hidden connections and in creating actionable intelligence?

Putting Social Networking to Work May Enable Cooperative Intelligence

Facebook, by far the most popular social networking tool on the Internet, boasts 350 million active users, 175 million of whom sign onto the site every day.

A Facebook user fills out personal information and can allow the program to access their email contacts to connect with other Facebook users. The user can search others by name to find friends, colleagues and associates. If a user isn't able to find a friend on Facebook, they can generate an invitation that is delivered by email.

Facebook users are identified by their real names, which creates an environment of trust, and also allows people to easily find friends. They add details about themselves, families, relationship status, preferences and interests. Users can join groups, which support causes, or are based around common interests. They can become “fans” of businesses or public figures. They can link to news stories, music and video as well as upload pictures and write status updates about their activities. Any activity a user engages in appears on their friends' *Live Feed*. Friends can comment on one another's activity, reply to threads on their personal feeds, called the *Wall*, and upload their own videos, pictures, music and news articles onto their friends' Walls. Mutual friends see interactions between two users as part of their own News Feed, but others do not. Facebook's privacy settings allow users to customize who can and cannot see their activities.

Through *Facebook Connect*, users can add updates to their Wall without signing into the actual site. Users of sites like Yelp.com, a popular consumer review site with a focus on local businesses, can choose the option of having all their reviews appear simultaneously on Yelp and Facebook. Similarly, users of the urban adventure site Foursquare.com can post their locations to Facebook, essentially inviting their friends into their game.

As the US intelligence community moves from a need-to-know model to a need-to-share model, a utility that allows members of the community to seamlessly connect with one another, draw information on a push rather than a pull basis, and effortlessly share information without having to actively take steps to do so may be very useful.

An important component of this plan would be linking databases to the *News Feed*. The 16 agencies that make up the US intelligence community all draw upon different databases (some of which have been referred to in the press as "vast data warehouses"). One might reasonably assume that each database has its strengths and weaknesses and that there is some redundancy in the information users pull from them. If the databases were connected to an active News Feed, users of an Intelink social networking site would see when their colleagues accessed, uploaded, or modified items within the databases. If the databases use a controlled vocabulary or user generated tags, keywords could trigger a notification to members of a user group or fan page.

Even if the users who receive the notification do not have access to the database itself, they would have some idea that a certain type of information exists. Because the site would not be anonymous, users would be trading in reputation and skill at tradecraft, and would have incentives to make connections across different agencies with others who could aid in their work, based on their evolving reputations.

Second, and more importantly, an algorithm needs to be created that can compare the contents of databases. While multiple databases might have information on, say, Jane Doe, one might have all her known addresses, educational history and places of work, while another might have recorded information on her habits, public remarks, and purchases at a certain relevant location. Yet a third database might contain observational information on her health. Taken together, one would be able to make better projections about potential threats posed by Jane Doe.

Clearly something must be done to improve data mining standards with the use of more sophisticated data aggregation methods, resource sharing and algorithmic interpretations to not only prevent relevant information from slipping between the cracks, but to take it a step farther and reveal previously overlooked connections. An algorithm would be able to compare the contents of classified databases without compromising the security of the information contained in the database. What it might reveal is that classified data and information are less and less valuable, and that classification and secrecy hinder the flow of information in an age that calls for real time responses.

Conclusion

The defense intelligence community found Intellipedia, its wiki, enormously useful, at least at the lower levels of the intelligence community. Between 2006 and 2009, it grew from 3,000 active users to 100,000. Security concerns have been addressed by creating three different versions of the wiki, used by groups with different security clearances.

Classified information may become less and less valuable as more information is openly available, through civilian maintained databases, public records, online in the form of social networking status updates, on blogs, in tweets, and elsewhere. The intelligence community must continue its transition from providing information between agencies on a need-to-know basis to a need-to-share basis. A networking utility for the intelligence community that draws upon some of the features of Facebook, along with an algorithm that compares and indexes both open-source and classified databases, may be able to hit the right balance of push-pull intelligence to respond to the constantly changing threat environment in which the intelligence community works.

One benefit of a utility like the one proposed in this paper is that it has a low learning curve, and technology doesn't take the place of smart humans, but rather could serve the function of making those smart humans smarter, faster. Being able to quickly understand the differences in the information contained in different databases would allow members of the intelligence community to make better choices about which databases to draw on, whether the information in classified databases is really more valuable than more readily available information and whether the intelligence community contains gaps that are filled in relevant ways by engaged civilian groups or by publicly available data.

Seeing what others are working on, and being able to quickly communicate across departments or agencies would result in more rapid coalescence of important information in the creation of intelligence products.

Bibliography

- Andrus, D. C. (2005). The Wiki and the blog: toward a complex adaptive intelligence community. *Studies in Intelligence*, 49(3), Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=755904 (2010, February 8)
- Baker, P. (2010, January 4). Obama's war over terror. *The New York Times Magazine*, Retrieved from <http://www.nytimes.com/2010/01/17/magazine/17Terror-t.html> (2010, February 8)
- Berkowitz, B. (2007, April 14). *Failing to keep up with the information revolution the DI and "it"*. Retrieved from <https://www.cia.gov/library/center-for-the-study-of-intelligence/csi-publications/csi-studies/studies/vol47no1/article07.html> (2010, February 8)
- Burke, C. (2007). Freeing knowledge, telling secrets: open source intelligence and development. *Centre for East-West Cultural and Economic Studies*, 11. Retrieved from http://epublications.bond.edu.au/cewces_papers/11 (2010, February 8)
- Carter, S.A. (1998, December 17). *Pull, push or shove: global broadcast service and intelligence support to maritime forces*. Retrieved from <http://www.stormingmedia.us/69/6916/A691663.html> (2010, February 8)
- Courson, P., & Turnham, S. (2003, July 30). Amid furor, pentagon kills terrorism futures market. *CNN.com*, Retrieved from <http://www.cnn.com/2003/ALLPOLITICS/07/29/terror.market/index.html> (2010, February 8)
- Frakes, W.B., & Baeza_Yates, R. (2004). *Information retrieval: data structures and algorithms*. Retrieved from <http://www.scribd.com/doc/13742235/Information-Retrieval-Data-Structures-Algorithms-William-B-Frakes#about> (2010, February 8)
- French, J.C., Powell, A.L., Callan, J, Viles, C.L., & Emmitt, T. (1999). *Comparing the performance of database selection algorithms*. Retrieved from <http://www.cs.virginia.edu/~cyberia/papers/SIGIR99.pdf> (2010, February 8)
- Jackson, J. (2009, February 18). *Intellipedia suffers midlife crisis*. Retrieved from <http://gcn.com/Articles/2009/02/18/Intellipedia.aspx> (2010, February 8)
- Kanter, R.M. (2010, January 4). *Northwest flight 253's lessons for leaders*. Retrieved from <http://blogs.hbr.org/kanter/2010/01/northwest-flight-253s-lessons.html> (2010, February 8)
- Leiter, M. (2008). An Interagency Threat Assessment Coordination Group (ITACG) Progress Report - Statement for the Record, Michael Leiter, Acting Director, NCTC. *13 March 2008*

Hearing before the House Homeland Security Committee's Sub-committee on Intelligence, Information Sharing and Terrorism. Retrieved (2010, February 8)

Miles, D. (2010, February 2). Review calls for stronger cooperation. *American Forces Press Service*. Retrieved from <http://www.defense.gov/news/newsarticle.aspx?id=57831> (2010, February 8)

National counterterrorism center key partners. (2009, February 13). Retrieved from http://www.nctc.gov/about_us/key_partners.html (2010, February 8)

NCTC and information sharing, five years since 9/11: a progress report . (2006, September 01). Retrieved from http://www.nctc.gov/docs/report_card_final.pdf (2010, February 8)

Stern, S. (2010, January 11). A Little knowledge is deadly dangerous. *ft.com*, Retrieved from http://www.ft.com/cms/s/0/baf685ec-fed9-11de-a677-00144feab49a.html?nclick_check=1 (2010, February 8)

Thompson, C. (2006, December 3). Open source spying. *The New York Times Magazine*. Retrieved from <http://www.nytimes.com/2006/12/03/magazine/03intelligence.html> (2010, February 8)

Information Science and Technology Directorate
Defense Technical Information Center
Ft. Belvoir, VA 22060-6218

DTIC-E-TR-2010/07 December 17, 2009
Information Science and Technology Directorate
Research Report

Information Needs and Behaviors - NASA Science Program Executives

by
Shannon Lantzy
University of Maryland
College of Library and Information Studies



Approved for public release; distribution is unlimited.

Copyright ©2010 (S. Lantzy). The U.S. Government and those authorized on its behalf are granted an unlimited non-exclusive, royalty-free, world-wide license to use, reproduce, or release the work for U.S. Government purposes.

Introduction

This paper presents a case study of the information-seeking behaviors, needs, and information use of a small group of government science program executives (PEs). Studies have reported on the needs of engineers as information users (Fidel & Green, 2004; Hertzum & Pejtersen, 2000; Leckie, Pettigrew, and Sylvain, 1996), as well as business executives (Auster & Choo, 1994; Boyd & Fulk, 2001; de Alwis, Majid, & Chaudry, 2006; Wetherbe, 1991). This group is a melange of the two: engineers by training and executives by work task.

Engineers' information needs vary depending on the task they have to accomplish (Hertzum & Pejtersen, 2000). They first seek information from other people (Hertzum & Pejtersen, 2000), preferably through informal channels (de Alwis et al., 2006) but also require information from journals, standards documents, and technical specifications (Hertzum & Pejtersen, 2000). Engineers prefer to use information sources that they are familiar with (Fidel & Green, 2004), and they are frequent users of their organizational library (Hertzum & Pejtersen, 2000). Business executives do not generally frequent libraries or use academic journals (Auster & Choo, 1994). Like engineers, they prefer to obtain information from people, most frequently from their direct subordinates (Auster & Choo, 1994). Executives often scan their external environment for information (Auster & Choo, 1994; de Alwis et al., 2006), and time spent scanning increases as task complexity increases (Boyd & Fulk, 2001). Executives' information needs are constantly changing; each decision requires a new set of information (Wetherbe, 1991).

The study population is a small group of co-located individuals within one organization at NASA. The Science Mission Directorate (SMD) manages NASA's unmanned space flight projects. Each flight project in development has a management team at Headquarters including a Program Executive (PE), a Program Scientist, and a budget analyst. A Program Executive works together with this team to define, integrate, and assess program activities and to provide policy direction and guidance to the program (NASA Office of the Chief Engineer, 2009). All the individuals in the study population have the same job description, expectations, governing policies, and work resources. A senior manager of the organization who oversees this group believes that the group often focuses too heavily on the technical side of their jobs, and hypothesizes that they behave "too much like engineers, not enough like managers" (SMD senior manager, personal communication, June 2009). Studying this group provided an opportunity not only to describe their information behaviors and preferences but to compare the results with research describing the norms of engineers and executives.

This study was designed to gather information about how PEs in the Science Mission Directorate seek information, their preferences about where to obtain information, and what kinds of information are most important to PE work.

Research Questions

The following research questions were addressed:

What are the demographics of NASA SMD Program Executives?

What work tasks do PEs perform?

What information sources do PEs find most important?

How do PEs seek information?

What is the relationship between PEs and their organizational library?

Methodology

A literature review was first conducted to determine the information seeking behaviors, needs, and preferences of both business executives and engineers. This review created interest in planning for this independent study. Through discussions with the study advisor, the research proposal was written, the study was planned, and preliminary information-gathering interviews were designed. The interview instrument was approved by the Institutional Review Board (IRB).

Two librarians and a library technician were interviewed to gather background information on PE information sources and their use. One PE was interviewed to gather background information about PE work tasks. Using information from the librarian interviews, the PE interview, and recommendations from SMD senior management, a survey instrument was drafted.

More data might have been gathered through interviews, however it was reasoned that a survey would result in data from a larger population. A survey was the chosen instrument for its potential breadth and speed.

The survey included questions about demographics (Q1-9), work locations (Q10-11), work tasks (Q12), information sources (Q13-23), information-seeking behaviors (Q24-26), relationship with the library (Q27-28) and two open-ended questions (Q29-30). The list of work tasks was obtained from the SMD Management Handbook (National Aeronautics and Space Administration [NASA], 2008). Information source options were created based on attendance at several "PE Forums" (informal monthly meetings of PEs and their senior manager), data from the PE interview, personal knowledge of the organization, and consultation with SMD senior management. Question 20 was designed to determine if and how PEs obtain historical program information. The library questions were written based on information obtained from earlier interviews of the library personnel.

The survey instrument was reviewed and rewritten several times through a co-editing process with the independent study advisor. The instrument was piloted with a university professor. Due to the very small population of potential respondents to the survey, it was not tested on a sample set of PEs. The survey instrument was approved by the IRB.

To get the maximum survey responses from this small population, the study was announced at the PE Forum meeting, and participation was encouraged and supported by SMD senior management. A senior manager arranged for the survey to be sent to the entire population of PEs via e-mail. It was distributed to thirty-eight individuals with an introduction and a link to SurveyMonkey, a web-based survey tool. Due to the time constraints of an independent study, the survey period was restricted to two weeks; more time, a prize incentive, or a more lengthy survey window might have yielded higher returns. A reminder e-mail was sent eight days after the initial distribution, and a final reminder several days later. The survey was held open for several days after the original deadline at the request of an individual PE.

Two recipients of the survey responded by e-mail that they no longer held the position of Program Executive. This reduced the population size to thirty-six. Twenty-two responses were collected and twenty-one were fully completed resulting in a 58% response rate.

The survey instrument is available in Appendix A.

Survey results

Demographics and Work Tasks

All but one respondent labeled themselves a Program Executive, and all but one responded "yes" to the question "are you a PE?". The twenty two respondents were evenly distributed across experience levels of 0-2, 3-5, 6-9, and 10+ years. The one outlier listed his/her title as "Manager," but reported that he/she had between six and nine years of experience as a PE. This response was included in survey results analysis; it is assumed that this individual had been a PE in the recent past. Each respondent was a civil servant. All four Science Mission Directorate Divisions were represented: Earth Science and Planetary had seven respondents each and Astrophysics and Heliophysics both had four. The majority (16) hold at least a Masters degree, just two hold only undergraduate degrees, four completed some graduate work, and three completed doctorates. All but two respondents have a degree in either engineering, physical sciences, or both. The two outliers have degrees in Mathematics, Business, or Computer Science & IT. A small number of respondents have Arts & Humanities degrees in addition to their engineering or physical science degrees. The respondents are between the ages of 40 and 59 except for one who was between 60 and 69. Two fifths of the respondent population was female.

Programs are usually run out of a NASA Center other than Headquarters. Twelve respondents are responsible for programs run out of both Goddard Space Flight Center (in the Washington Metro area) and the Jet Propulsion Laboratory (JPL, in Pasadena, CA). All but four respondents have at least one program managed out of a Center requiring air travel. Twelve respondents (55%) travel between one and five days per month, eight (36%) travel less than once per month, and two travel between six and ten days per month. One PE noted that "Lack of travel budgets makes it near impossible for me to attend quarterly project meetings." Another noted that he/she visits Goddard Space Flight Center, Wallops Flight Facility, and Langley Research Center more frequently because of their proximity.

Respondents were asked to report how frequently they perform ten specific tasks as a Program Executive. Over 90% reported that they frequently monitor, report, and keep track of program/project status, and maintain their network and working relationships. Eleven (50%) noted that they frequently make decisions for or about their program, however seven said decision-making was rare. One comment noted that PEs do not make decisions, they make recommendations. The table below shows the number and percentage of responses for each rating of each task.

Table 1: PE Work Task Frequency Ratings

Please indicate the tasks you perform as Program Executive	Never	Rarely	Sometimes	Frequently
Monitoring and reporting program/project status			1 (5%)	21 (95%)
Assessing program performance (including "gate" reviews)		2 (9%)	7 (32%)	13 (59%)
Formulate new missions	6 (27%)	4 (18%)	10 (45%)	2 (9%)
Budget formulation		3 (14%)	10 (45%)	9 (41%)

Maintaining network, working relationships				22 (100%)
Liaising with other organizations (both internal and external)			7 (32%)	15 (68%)
Writing & managing FADs, PCAs, and other programmatic documentation	1 (5%)	5 (23%)	8 (36%)	8 (36%)
Providing policy guidance to program		2 (9%)	10 (45%)	10 (45%)
Keeping track of program activities/status			2 (9%)	20 (91%)
Making decisions for/about the program	1 (5%)	7 (32%)	3 (14%)	11 (50%)

Information Sources

Ratings of fifty-five information sources were organized in order of average rating of importance (see Table 2.1 below). Six of the ten most highly rated information sources were people. Project personnel (2.91), a PE's Division Director (2.86), Program Scientists (2.82), and Resources Analysts topped the list. The most important information sources other than people were SMD publications (2.68) and the ScienceWorks home page (2.50) (a portal page for a collection of SMD Information Systems). The five lowest-rated sources, excluding the "other" categories, were the NASA HQ librarians (0.77), HQ library books (0.73), NRC Action Tracking System (0.68), ASK Magazine (0.64), and SMD Spacebook (0.36). The table below shows all information sources according to their average rating of importance.

Table 2.1: Information Source Average Ratings – Importance (High to Low)

0 – Not at all 1 – Low 2 – Moderate 3 – High		
Information Source	Type	Rating Average
Project personnel	People	2.91
Your Division Director	People	2.86
Program Scientists	People	2.82
Resource Analysts	People	2.77
SMD publications (e.g. Mgmt Handbook, Science Plan, etc.)	Text	2.68
Other PEs from your division	People	2.64
Center Program Offices personnel	People	2.64
Informal meetings (e.g. "hallway meetings")	Meetings	2.55
ScienceWorks home page	SMD IS	2.50
Center project meetings (e.g. Project Office meetings)	Meetings	2.50
SMD Front Office (DAAs, AAs, Chiefs)	People	2.48
Google	Websites	2.36
Division staff meetings	Meetings	2.32
Center project review meetings (e.g. MSRs)	Meetings	2.32
Your project's or program's home page	Websites	2.27
Secretaries/Administrative Assistants	People	2.19
SMD Web site (nasascience.nasa.gov)	Websites	2.00
PAO team	People	2.00
NODIS (nodis.gsfc.hq.nasa.gov)	Websites	1.95
Colleagues outside of NASA	People	1.95
PE Forum	Meetings	1.91
NASA Portal (nasa.gov)	Websites	1.86
Weekly Reporting System	SMD IS	1.86
SMD shared drives	SMD IS	1.86
Milestones	SMD IS	1.77
Other PEs from other divisions	People	1.77

Information Source	Type	Rating Average
NASA-sponsored conferences	Meetings	1.68
Non-NASA conferences	Meetings	1.67
Requirements Management System	SMD IS	1.64
Trade magazines	Text	1.59
Newspapers	Text	1.55
Personal books (including non-NASA library books)	Text	1.45
International Agreements Database	SMD IS	1.45
SMA	People	1.45
Academic journals	Text	1.41
All Hands meetings	Meetings	1.41
OCE team	People	1.27
Procurement team	People	1.23
ITA	People	1.23
OGC team	People	1.18
Marshall SMD Web site (science.nasa.gov)	Websites	1.14
SOMD colleagues	People	1.14
NASA HQ librarians	People	0.77
HQ library books	Text	0.73
NRC Action Tracking System	SMD IS	0.68
ASK Magazine	Text	0.64
SMD Spacebook	SMD IS	0.36

Respondents were asked to consider meeting tools like meeting minutes, and audio and video conferencing tools. Five respondents (23%) reported that meeting minutes are never or rarely available, thirteen (59%) reported that they sometimes made available, and four (18%) said minutes are often made available. Thirteen (59%) said that minutes are either often or always useful, nine (41%) reported that they are sometimes useful, and no one said that minutes are either never or rarely useful. Over 77% found audio and video conferences to be often or always useful (18, 17 respectively), but only 9% find it easy to use video conferencing tools. One respondent noted that he or she depends "on others to set up video-conferences" and another reported that "Video conference controls seem overly complex and almost impossible to help troubleshoot when problems occur."

When asked what information sources were the most useful during a significant risk event, the average responses rated meetings, status reports, and colleagues as the most useful (rated over 4 in 0-5 scale) and Standing Review Board reports and SMD web applications moderately useful. Press and NASA websites were rated much less useful (< 2). The table below shows the average ratings of each source.

Table 3: Sources of Information for Use During Program Risk

What were the most useful sources of information for evaluating and managing the risk?	0 – Not at all useful 5 – Extremely Useful
Meetings	4.52
Status reports	4.14
Colleagues	4.10
Standing Review Board (SRB) reports	3.67
SMD Web applications	2.29
NASA web sites	1.95
Press	1.42

One question was designed to gather information about retrieving historical program data. Six (27%) respondents agreed that information from past programs is easy to obtain while fourteen (64%) disagreed (see Table 4, below). All but one respondent agreed that historical

program data is useful. Eight (36%) respondents reported that they do not have the tools they need to preserve information about their programs. There were two interesting comments offered in response. A respondent wrote, "preserving information is difficult and corporate knowledge is often lost when there are changes of PE." Another PE noted that "SMD has only a minor document repository."

Table 4: Storing and Accessing Historical Program Data

Think about the tools you use and how effective they are for your needs.	Agree or Strongly Agree	Disagree or Strongly Disagree
When I need information from a past program, it is usually easy to obtain.	33%	67%
Historical program data are useful to me.	95%	5%
Historical program data are easy to find.	29%	71%
I feel that there are ample opportunities to share work stories with colleagues.	65%	35%
I have all the tools I need to communicate information about my program.	86%	14%
I have all the tools I need to preserve information about my program.	62%	38%

Center Monthly Status Reports (MSRs) and Center Weekly Written Reports (Weeklies) are regular reports generated by the Center project teams for Headquarters use. These two reports were evaluated according to eight adjectives. Over 90% of respondents reported that the MSRs were consistent, reusable, easy to use, and accurate. Eighty percent thought that the MSRs were efficient and valuable, 71% found them information rich and easy to locate.

Table 5.1: Ratings of the Center Monthly Status Reviews (MSRs)

MSRs	Yes	No
Accurate	90%	10%
Consistent	95%	5%
Easy to locate	71%	29%
Easy to use	95%	5%
Efficient	81%	19%
Information rich	71%	29%
Reusable	95%	5%
Valuable	86%	14%

Eighty percent or more of the respondents felt that the Weeklies are consistent, reusable, efficient, and valuable, 75% said they are useful, and 70% reported they are easy to use. Thirteen of the twenty respondents (65%) felt that the Weeklies are information rich or easy to locate. One respondent does not have access to the Weekly Reports, another said that his or her ratings were based on the best of the Center reports he receives, but that they are not all equal. One respondent mentioned that the reports are not interesting from a Headquarters perspective

and another noted the report is "too high level for my use."

Table 5.2: Ratings of the Center Weekly Reports (Weeklies)

Weeklies	Yes	No
Useful	75%	25%
Consistent	79%	21%
Easy to locate	65%	35%
Easy to use	70%	30%
Efficient	85%	15%
Information rich	63%	37%
Reusable	79%	21%
Valuable	80%	20%

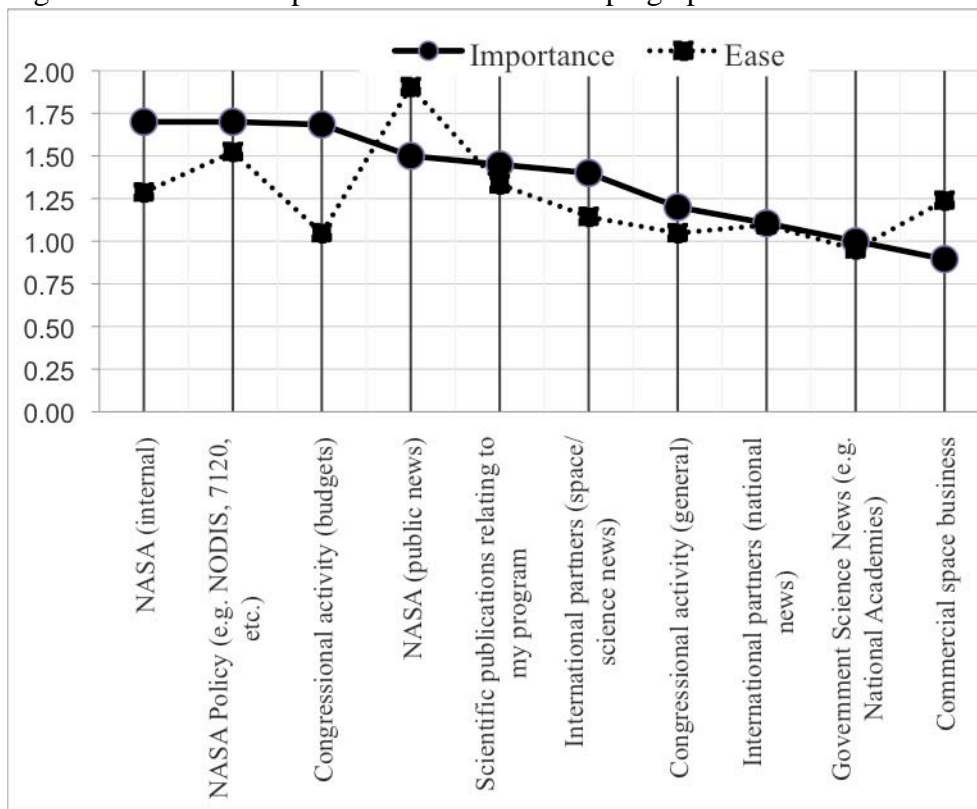
Four specific categories of information were assessed according to their reliability. Technical information was reported as the most reliable (3.38 of 4), programmatic information was slightly less reliable (3.10), and schedule and resources were evaluated as the least reliable (2.90 and 2.86, respectively). All four types were rated as "usually" reliable by the majority of respondents, four individuals feel that schedule and resources information are sometimes reliable, and one respondent selected that resources information is never reliable. Interesting comments included in the responses: "The nature of flight projects on development is very dynamic and may change faster than a weekly basis;" "...two year money is really one year money and gets to the programs very late;" "Risk reporting is often weak, typically lacking insight on implications of risk occurrence and recovery;" and that "the answers would be different for project versus program information."

Information-Seeking Behavior

One question was designed to determine how PEs obtain information from other people. There were eight communication mechanisms, including four computer-mediated methods. The most likely method was to "send an email," and the next three highest-rated were non-computer mediated communication types (phone calls or scheduled and impromptu meetings). PEs are not at all likely to broadcast a message, post on a message board, or send an instant message. It should be noted that this response did not indicate preference for but rather likelihood of use. Two PEs indicated that they would use IM and other media (social networks or SMS) if their colleagues did as well, or if their projects adopted the technologies.

Two questions were posed to measure the PEs' estimation of how important and how easy it is to "keep up" with various information sources. Respondents reported that internal NASA news (1.70 of 2) and policy (1.70) were the most important while government science and commercial space news (1.00 and 0.89) were least important. On average, all of the information sources listed were rated as at least somewhat important. One respondent felt that science publications relating to his/her program were not at all important. Each source was reported to be relatively easy to keep up with; on average the sources were all somewhat easy to keep up with. The table below shows each kind of information with its importance rating versus the effort that keeping up with it requires.

Figure 1 shows the importance and ease of keeping up with the listed information categories.



Library Use

Several questions measured PE awareness and use of the Headquarters management and policy library. The first question asked about their library use in the past month. Thirteen (62%) respondents reported that they did not use the library. One respondent reported using the library three to four times per week. The balance of the PEs (33%) reported using the library between one and five times in the last month. Thirteen (65%) respondents reported that they are aware of the services that the HQ library provides; seven (35%) did not. Two respondents commented that, while they do not frequently use library services, when they do the service is "EXTREMELY valuable" and "most helpful." In an open-answer comment at the end of the survey one PE noted "HQ Library may be valuable...[but] I simply have not taken the time to research what is available there." Another reported that "I probably could use [the library] more often, but I just don't think to do it, or the pace of my work day tends to discourage me from taking the time to use it." The table below shows how the PEs who were aware of the library use (or do not use) its services.

Table 6: Library Services Use

Library Services	Agree or Strongly Agree	Disagree or Strongly Disagree
I use the library staff to help with literature reviews.	50%	50%
I use the library staff to facts and data in a hurry.	31%	69%
The library provides vital information for my job.	42%	58%
I like to visit the library to get away from my desk.	33%	67%
I use the library to get materials through Interlibrary Loan.	46%	54%

To allow for responses that we had not provided for in structured survey responses, two free-form answer questions were given. Respondents were asked to fill in the blank: "If I had better access to _____, it would make my job much easier." The responses included:

- "Real-time project schedule information"
- "Travel funding"
- "Project and program documents"
 - "other program documentation"
 - "project documentation databases"
 - "Project day-to-day work product files--like presentations and reports...My project needs a good configuration management person, and/or system that would allow me to access project information on my own, rather than always needing to interface with project personnel to get it."
 - "Historical Program information (Pre-electronic)"
 - "Project technical status information and meetings"
 - "Meetings and technical forums"
- "ViTS [video teleconference system] and Webex [web conference service]"
- "Fewer passwords and systems"
- "Congressional budget bill status"
- "SMD AA's decisions", "SMD information"
- "The major science journals (ApJ, AJ, MNRAS, A&A, JGR, etc.)"
 - "more science web journals"
- "detailed budget information"
 - "budget and schedule data"

The following are answers to an open ended question at the end of the survey. It reminded the respondent of the types of information that were asked about in the course of the survey and asked for any further comments.

1. HQ Library may be a valuable source of information. I simply have not taken the time to research what is available there.
2. Budget and schedule data are not readily available. I must request these. They should be posted in one publicly available website for all to use simultaneously. Don't understand why we are keeping schedule and budget data so secret."

"In general, these questions focus on how we currently access and use information. But it seems to me that the current methods are haphazard in some respects and could be more efficient or more effective. Much of this depends on proper use and adoption by PEs and project personnel. One of my previous projects used blogs, instant messaging, and a good configuration management system (and config manager) with great success. I always knew where to go for information and who to contact to get it if I couldn't find it on my own. My current projects do not have this kind of use of systems."

"Library provides an important service to HQ"

"No information is provided by the library staff to the new people"

"A better, easier, online, consistent archiving system would be great. Also, the ability to easily scan and store documents electronically. Paper is unwieldy and unnecessary and should be made obsolete."

"Expand the online access to e-journals"

"I like having the library around, but as a PE, I don't use it often. Program Scientists have noted they need access to certain journals that the Library does not have subscriptions to."

Discussion

Demographics and Work Tasks

This study was designed to look at what was assumed to be a homogeneous group. As expected, the respondents were middle-aged and almost all engineers, 60% male, 40% female, and all hold (or have recently held, in the case of one) the same job. Contrary to expectations, PEs do not all do the same job. As represented by the survey responses, PE work tasks are not consistent. Some PEs formulate new missions and make decisions, some do not. Some write programmatic documentation, some do so only rarely. The Leckie et al. (1996) information-seeking behavior model of professionals shows that information-seeking is affected by users' work roles and associated work tasks. It is not surprising, therefore, that their information-seeking behaviors and source preferences are inconsistent within the group.

A cross-tabulation (cross tab) analysis was attempted to determine whether there is a clear difference in preferences between respondents with PhDs versus those without, but there were only three respondents who fell into this category. Consequently, there were an insufficient number of respondents to control for other demographic factors and therefore the cross tab could not be used. Similarly, an organizational division cross tab was not possible because two of the four divisions had only four respondents.

Information Sources: Texts, Websites, Organization Information Systems, and External

Published texts were rated of just average importance compared to the rest of the sources listed. This might have been anticipated given the fast pace of PE work. When examined by individual respondent, data showed that their responses were mixed. Three PEs thought newspapers were not at all important to their work, and yet three rated newspapers highly. The individual PEs' average rating of texts, excluding SMD publications, ranged from 0.14 to 2.57. This indicates that there are some individual PEs who prefer to use texts more than other PEs.

ASK Magazine was expected to be an important information source. ASK stands for "Academy Sharing Knowledge," its sub heading reads "The NASA Source for Project Management and Engineering Excellence" and it is currently edited by a prominent knowledge

management researcher, Lawrence Prusak (ASK Magazine, 2008, 2009abcd). It is not, however, a publication that PEs find important. It is possible that the focus of the magazine is too low-level to be useful to PEs at Headquarters, but it is striking that the magazine is placed second to last on the information sources table.

Not surprisingly, "Google" was the top-rated website source; it is synonymous with the public internet. NASA Watch should have been an option within the question, as several added it in their comments. Program executives find their project websites important, which implies that public project websites are populated with information useful to internal audiences. The HQ SMD website was rated of moderate importance, which is similarly surprising due to its public-facing nature.

The SMD HQ social networking tool, Spacebook, was the lowest-rated information source overall. It was reasonable to assume that a social networking site might be useful to PEs so that they may have better access to people in their networks. Project personnel, the most highly-rated information source, are off-site; Spacebook could be used as an additional tool for keeping in contact. However, upon further consideration of the demographics of this population, lack of social networking use should not come as a surprise. A study by the Pew Internet & American Life Project found that only 11% of respondents aged 50-64 and 25% aged 30-49 have ever used a social networking tool, and only 2% and 9% reported having used this kind of tool in the last 24 hours (Lenhart, 2009). Program Executives, all between 40 and 70 years old, might not be inclined to use social networking tools on the job until they become more familiar with them outside the work context. Further research might determine other reasons why this tool is not used by or is not important to PEs, and whether it could be made useful. A follow-up survey or interviews could be conducted to probe whether PEs are comfortable using social network sites.

The ScienceWorks home page is the gateway to program status reports, requirements, and milestones documentation. It was in the top ten most highly rated information sources overall. While they do not use a social network tool, this group does use information systems. In addition to ScienceWorks and its components, SMD's shared drives are available for storing and sharing program and project information within HQ. The respondents' median rating of this source indicates that they are probably more likely to ask others for information than to search for it on the drives. We cannot infer the definitive cause of the neglect, but it is possible that the drives may not have much information, may be too limited to access from outside of HQ, or they may be especially difficult to use. In addition to the systems mentioned in the survey, ten other information systems managed outside of HQ were identified in comments. These systems are not specific to the position of Program Executives, but rather to the programs they oversee. One respondent reported it is difficult to maintain awareness of and logins for a plethora of systems. PEs spend time "keeping up" with or scanning a variety of news environments. Respondents felt that NASA external news is the easiest source to keep up with. This was expected: each morning an SMD public affairs officer sends an e-mail with news clippings of NASA news from the previous day. Congressional budget activity was rated both highly important as well as somewhat less easy to collect. This is surprising: the library provides a congressional budget alert service (NASA Headquarters Library, 2009), however PEs are either unaware of the service, or it does not provide the type of budget information they require. Respondents reported that keeping abreast of NASA internal news is slightly difficult, but important. There is a trend across the ratings and comments that suggests program and project files are in disparate places, are hard to locate if they are historical, require many passwords to be

remembered, and that a change in program requires a change in information processes. Some PEs expressed the lack of available tools for preserving program information. The high use of ScienceWorks suggest that PEs are not generally opposed to using an online information system for program information, but they would like new processes or system features that can help organize and archive their information assets.

Information Sources: People and Meetings

Consistent with research on both business executives and engineers, PEs rated people the most important information sources overall. One respondent noted that it is particularly valuable to interface with PEs from other divisions who manage programs similar to his/hers, however this was an outlier. One manager at NASA (Russ Wertenberg, personal communication, Summer 2009) says that managers must maintain an awareness of the information from people one level above and two levels below them in the organization. Most of the highly rated information sources are people in positions either within the program team, project team (just below the program level), or the division director (the PE's supervisor). The other highest-rated human information sources were fellow PEs from one's own division.

PEs' prefer informal meetings to formal reporting mechanisms and regularly scheduled meetings. They find audio conferences and video conferences useful despite difficulty with the video equipment. Respondents noted several times throughout the survey that their travel funds are insufficient. This suggests that while virtual teleconferences supplement travel, PEs prefer seeking information from people in-person. PEs would benefit from the transformation of video and audio conference tools from arduous technical systems into easy, one-button services. The easier these tools can be made, the more likely they will be usable in informal meetings.

The majority of PEs find meeting minutes useful, yet they are not always recorded or made available. PE's high use of ScienceWorks indicates that if meeting minutes were posted there, they might provide value to the PE. Since meetings are fairly important, missing a meeting causes a PE to miss important information. For this purpose and for historical record, meeting minutes are of high importance.

Information-Seeking Behavior

The PEs were asked to rate their preferred sources of information during a risk event. The data showed that the most useful information was obtained in discussions with colleagues, but written status reports from centers or review boards were also important. Websites and press were rated much lower. This question only hints at the nature of information-seeking during a risk event, but it suggests that internal information is most useful.

PEs prefer to send e-mails, make phone calls, and knock on doors when they need a piece of information. These are common and established office communication mechanisms, unlike the newer tools such as Instant Messages (IM), message boards, tweets and other social media. There are a number of possible reasons that this is the case, but three comments from this section support the conclusion that at least some of the PEs would use these other tools if they were both available and if others knew how to use them. Since there are IM, blog, social network, and wiki tools available at NASA HQ, coordination of their use might be the problem.

Library Use

Studies show that though engineers use libraries, including in-house libraries, to obtain information (Leckie et al., 1996), executives are infrequent library users (Auster & Choo, 1994).

In this respect PEs behave much more like business executives than engineers. Out of eighteen possible human sources of information, the rating of HQ librarians was eighteenth. This is not, however, an indictment of the value of the library. Seven respondents were unaware of the services the library provides. Some respondents commented that they did not use the library often, but when they did it was extremely useful. The data indicate that library services are not well known. Fidel & Green (2004) found that engineers are unlikely to use a source that they are unfamiliar with. To make the best use of the library, its clientele must be both aware of its services and comfortable with their use.

From the interviews it was clear that PEs report themselves as indifferent library users, however the librarians did have some suggestions on how they would make changes that could increase PE patronage. For example, the librarians would like to add more science journals and databases to their collection, as well as initiate a library orientation program for new employees.

PEs expressed concern that new people in the Directorate are not made aware of the library. During interviews, the librarians expressed interest in learning more about PE information needs so that they may effectively promote library services and better serve the SMD population.

Conclusion

One PE made an observation about the survey design that is important to consider while interpreting all this data: "In general, these questions focus on how we currently access and use information." Indeed, the survey was designed to gather information about the current preferences and behaviors of Program Executives in the Science Mission Directorate. That task was accomplished: PEs behave much like business executives, and not like engineers in their library use. PEs need to have informal meetings with people more than anything else to do their job, but a variety of other sources are important and probably indispensable. They are not users of social networking sites or tools for work tasks, but they do use a number of web-based information systems. Above all, they value information from human sources.

The expectation that this population would be a homogeneous group proved false. SMD Program Executives do not fit squarely into a category of information users, such as engineers or business executives. Rather, they are individual users with unique sets of requirements, even among their own small population.

Headquarters librarians must increase their promotion and training of services. PEs are not reluctant to use the library, but they lack the familiarity that they need. Training should be mandatory for new PEs and probably all SMD employees. They have many other information sources and systems to juggle.

PEs ask other people for information first, even when they are just looking for a file that already exists. Program and project information should be organized so that it is easy to locate, especially sources like reports, which are produced on a regular basis and could be located in one place. Where organization already exists, it must be publicized. This may still not be enough. Information must be organized, publicized, and easy to access.

More research is needed to create a deeper understanding of PE information needs. Studies into program data archiving, program and project data management, schedule and resources data accuracy, and virtual meeting tools would benefit both the SMD senior management, and other organizations with similar information environments.

The SMD Management Handbook (2008) and policy directives describe the PE duties in detail, which indicated that PE work tasks would be much more standardized than they proved to

be. As work tasks vary, so do information needs (Leckie et al., 1996). However there is enough consistency in the data to conclude that PEs behave as expected for their position as executives.

References

- ASK Magazine. (2008, Fall). Issue 32. Retrieved December 16, 2009 from <http://askmagazine.nasa.gov/issues/32/index32.php>
- ASK Magazine. (2009, Winter). Issue 33. Retrieved December 16, 2009 from <http://askmagazine.nasa.gov/issues/33/index33.php>
- ASK Magazine. (2009, Spring). Issue 34. Retrieved December 16, 2009 from <http://askmagazine.nasa.gov/issues/34/index34.php>
- ASK Magazine. (2009, Summer). Issue 35. Retrieved December 16, 2009 from <http://askmagazine.nasa.gov/issues/35/index35.php>
- ASK Magazine. (2009, Fall). Issue 36. Retrieved December 16, 2009 from <http://askmagazine.nasa.gov/issues/36/index36.php>
- Auster, E., & Choo, C. W. (1994). CEOs, Information, and Decision Making: Scanning the Environment for Strategic Advantage. *Library Trends* 43 (2) 1994: *The Library in Corporate Intelligence Activities*: 206-225.
- Boyd, B., Fulk, J. (2001). Executive Scanning and Perceived Uncertainty: A Multidimensional Model. *Journal of Management*, 22, 1-21.
- de Alwis, G. Majid, S., Chaudry, A. (2006) Transformation in managers' information seeking behaviour: a review of the literature. *Journal of Information Science*, 32, 362-377.
- Fidel, R., & Green, M. (2004). The many faces of accessibility: engineers' perception of information sources. *Information Processing and Management*, 40, 563-581.
- Hertzum, M., & Pejtersen, A. M. (2000). The information-seeking practices of engineers: searching for documents as well as for people. *Information Processing & Management*, 36, 761-778.
- Leckie, G., Pettigrew, K., Sylvain, C. (1996). Modeling the Information Seeking of Professionals: A General Model Derived from Research on Engineers, Health Care Professionals, and Lawyers. *The Library Quarterly*, 66, 161-193.
- Lenhart, A. (2009) Adults and Social Network Websites. *Pew Internet & American Life Project*, January 2009. Retrieved December 13, 2009, from <http://www.pewinternet.org/Reports/2009/Adults-and-Social-Network-Websites.aspx>
- National Aeronautics and Space Administration. (2008). *NASA Headquarters Science Mission Directorate (SMD) Management Handbook*.
- NASA Headquarters Library. (2009). *NASA Headquarters Library: Subscribe to Alerts*. Retrieved December 16, 2009, from <http://www.hq.nasa.gov/office/hqlibrary/request/alerts.htm>
- NASA Office of the Chief Engineer. (2007-2012) *NASA Procedural Requirements: NASA Space Flight Program and Project Management Requirements*. Chapter 3. Retrieved December 15, 2009, from http://nodis3.gsfc.nasa.gov/displayDir.cfm?Internal_ID=N_PR_7120_005D_&page_name=Chapter3
- Wetherbe, J., (1991). Executive information requirements: getting it right. *MIS Quarterly*, 15, 51-65.